

of an auction mechanism. In order to have an auction, there must be a commodity to be auctioned -- namely the COLR obligation. If a party wins the auction, it must be possible for that firm to take on the COLR obligation in return for the support level it has bid. This means that commissions must be able to assign the obligation they have defined to a carrier other than the ILEC. As GTE has shown supra, the Act clearly allows for this to occur.

Similarly, it must be possible for a carrier -- including the ILEC, to lose the auction. In this case, the carrier should lose access to the COLR funding. But it should also be relieved of any COLR obligations, and be treated symmetrically with other carriers who are not COLRs. Note that in the auction structure GTE proposes, the incumbent LEC would only be able to lose the COLR auction in the event that at least one other firm wins it. Thus as the Act requires, the availability of service would be guaranteed even if the COLR designation changes from the LEC to another carrier.

If other parties entered the auction knowing that the LEC could not "lose", it would certainly interfere with the auction outcome. Each party could prepare its bid secure in the knowledge that the LEC would be required to provision it as an underlying carrier. Not only would this be unfair to the LEC; it would also prevent the auction from revealing information about the bidders' costs. Instead, the bids would simply reflect the rates which had been established for resale of the LEC's facilities or bundled services.

Fortunately, the 1996 Act clearly provides the Commission with the authority it needs to define a COLR auction process in such a way that the incumbent LEC can lose.

1. Subsections 254(a) and (b) place firmly on the FCC -- acting so as to take account of Joint Board recommendations -- responsibility to develop and implement a Universal Service Plan that is effective in maintaining and promoting universal service throughout the country. Specifically, one of the subsection 254(b) "principles" upon which "the Joint Board and the Commission shall base policies for the preservation and advancement of universal service" is stated in subsection 254(b)(5): "There should be specific, predictable and sufficient Federal and State mechanisms to preserve and advance universal service." Even more significant is the mandate of subsection 254(e), which says, "Any such [Federal universal service] support should be explicit and specific to achieve the purposes of this section [254]."

2. Under subsection 160(a) (subsection 10(a) of the 1996 Act), Congress gave the FCC broad power to "forbear from applying any regulation or any provision of this Act to a telecommunications carrier or telecommunications service [or a class thereof] in any or some of their geographic markets...." Under subsection 160(a)(1), (2) and (3), exercise of this power depends upon an FCC determination that amounts to saying regulation is not necessary and forbearance is consistent with the public interest.

3. A further qualification on this power of the FCC serves to stress the scope of the power. Subsection 160(d) says the Commission (putting aside subsection 254(f), not relevant to this discussion) "may not forbear from applying the requirements of [sub]section 251(c) or 271 under subsection (a) of this section [160] until it determines that those requirements have been fully implemented." This makes it unmistakable that

the FCC may forbear from applying the subsection 251(c) and section 271 requirements once there has been a showing of full implementation.

4. Driving home the force of the FCC's broad power of forbearance is subsection 160(e), which makes the FCC's forbearance decision preemptive. This subsection says a "State commission may not continue to apply or enforce any provision of this Act that the Commission has determined to forbear from applying under subsection [160] (a)."

5. In harmony with the overall thrust of the 1996 Act looking to deregulation as competition becomes established, subsection 214(e)(4) is concerned with relinquishment of a universal service obligation. This provision contemplates a case where more than one eligible telecommunications carrier (Etel) serves a particular area. It sets out the procedures by which a State commission, upon advance notice by an Etel that it wishes to relinquish a universal service obligation, may permit such relinquishment provided the remaining Etel(s) are required to ensure that all customers served by the relinquishing carrier will continue to be served. Such notice must be "sufficient ... to permit the purchase or construction of adequate facilities by any remaining [Etel]," and the purchase or construction should be completed within a year of State commission approval.

6. Subsection 214(e)(4) nicely accommodates the GTE auction scheme. The duties of an ILEC under subsection 251(c) are the counterpart of Carrier of Last Resort (COLR) obligations. As proposed by GTE, an existing COLR/ILEC could be discharged of the COLR/subsection 251(c) obligations in favor of a successful bidder qualified and willing to assume these obligations, in exchange for which the successful

bidder would receive universal service support. Alternatively, the existing COLR/ILEC might choose to continue in that capacity, but then it would have to share universal service support with the successful bidder and that support would be set at the per-customer amount of the successful bid. The FCC's broad power of forbearance, discussed *supra*, provides ample authorization for FCC action -- preempting the State commission as necessary - discharging a COLR/ILEC from subsection 251(c) obligations in accordance with GTE's scheme.

7. Still another indication in the 1996 Act that Congress contemplated a relinquishment of COLR/subsection 251(c) obligations upon a new ILEC assuming such obligations is contained in subsection 251(h)(2), under which the FCC "may, by rule, provide for the treatment of a local exchange carrier (or class or category thereof) as an [ILEC] for purposes of this section [251] if:

"(A) such carrier occupies a position in the market for telephone exchange service within an area that is comparable to the position occupied by a carrier described in paragraph (1) [which defines ILECs];

"(B) such carrier has substantially replaced an [ILEC]; and

"(C) such treatment is consistent with the public interest, convenience, and necessity and the purposes of this section "

8. Thus, Subsection 251(h)(2) contemplates that, under the FCC/Joint Board Universal Service Plan, an ILEC would be "substantially replaced" by another firm occupying a position in the market comparable to an ILEC's position. Accordingly, it provides for the new ILEC/COLR to assume those obligations; while discharge of the replaced ILEC/COLR is accommodated under the FCC's broad and preemptive forbearance power discussed *supra*.

9. These provisions hang together. They offer a coherent statutory plan well suited to implementing the GTE proposal, which was extensively discussed with congressional staffers as well as Representatives and Senators.

51. What, if any, safeguards should be adopted to ensure that large companies do not bid excessively low to drive out competition?

See response to question number 49, *supra*

52. What safeguards should be adopted to ensure adequate quality of service under a system of competitive bidding?

The task of monitoring and enforcing COLR performance of their obligations rests in the first instance with the states.³² Further, under the plan proposed by GTE, no additional measures are needed to ensure that COLRs use support only for the intended services, because payment of support, tied to the performance of the obligations established for COLRs by the state, is just sufficient to compensate the COLR for that performance.

³² There is no need for new Federal quality monitoring activities or performance-based measurements inasmuch as: (i) quality standards should be part of the obligations established by the state agency for receipt of support; (ii) state agencies already have a wide variety of service quality criteria and measurement mechanisms in place; and (iii) the ARMIS 43-05 report already provides service quality information to the FCC.

In any event, there is nothing about the auction process that creates any concerns with respect to quality enforcement that would not be present in the same degree if the support is determined on the basis of cost. If the concern is that the firm would be motivated to shirk its obligations because the support is set too low, GTE responds that a too-low support level is more likely to result from error or misspecification in the cost estimate than it is from a bid that the carrier itself has submitted. Note also that the proposed auction scheme would base support for all COLRs on the highest accepted bid, rather than on the lowest bid.

53. How is collusion avoided when using a competitive bid?

As Professor Milgrom explains, the single-round, sealed bid format proposed here is not vulnerable to collusion among the bidders.

54. Should the structure of the auction differ if there are few bidders? If so, how?

See response to question number 49, *supra*.

55. How should the Commission determine the size of the areas within which eligible carriers bid for universal service support? What is the optimal basis for determining the size of those areas, in order to avoid unfair advantage for either the incumbent local exchange carriers or competitive carriers?

GTE proposes that the geographic units used for the auctions, and for the assignment of COLR obligations, should be small, standard units, such as CBGs. This allows the bidding to establish separate support levels which will capture differences in cost across areas. Further, because each area is small, the requirement to serve the entire area will not create an unreasonable barrier to entry for a prospective COLR. Each entrant can determine the set of CBGs that would comprise the area it wishes to serve, and submit NOIs for those CBGs. The framework is thus very flexible, and adaptable to the business plans of the entrants. GTE submits that there is no arbitrary

grouping of CBGs the Commission could establish in advance that would accommodate firms' business plans as well as the groupings they would create for themselves through the NOI process.

Because the bidding cycles would group CBGs together to be auctioned at the same time, and because the proposed single-round auction is inherently simple, GTE believes that it has structured the proposal to allow the large number of CBGs to be auctioned efficiently, over time, as they are noticed by the carriers.

Benchmark Cost Model (BCM)

56. How do the book costs of incumbent local exchange carriers compare with the calculated proxy costs of the Benchmark Cost Model (BCM) for the same areas?

GTE's prior submissions in D.96-45 and CC Docket No. 80-286 addressed many of the issues within the questions pertaining to the Benchmark Cost Model. GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

57. Should the BCM be modified to include non-wireline services? If wireless technology proves less costly than wireline facilities, should projected costs be capped at the level predicted for use of wireless technology?

No, there is no need to modify the BCM to include non-wireline services. The starting point for initiation of a new universal service support plan should be today's ILEC network design and the associated costs because that is the network used to provide local service today. When new entrants, perhaps using wireless technology, desire to serve a high cost area and be eligible for universal service support, the auction process proposed by GTE obviates the need to accommodate wireless and other technologies in a cost model. The bidding process itself will provide its own estimates of service costs through the support levels bid by each potential provider.

58. What are the advantages and disadvantages of using a wire center instead of a Census Block Group as the appropriate geographic area in projecting costs?

GTE's prior submissions in D.96-45 and CC Docket No. 80-286 addressed many of the issues within the questions pertaining to the Benchmark Cost Model. GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

59. The Maine PUC and several other State commissions proposed inclusion in the BCM of the costs of connecting exchanges to the public switched network through the use of microwave, trunk, or satellite technologies. Those Commenters also proposed the use an additional extra-high-cost variable for remote areas not accessible by road. What is the feasibility and the advisability of incorporating these changes into the BCM?

GTE's prior submissions in D.96-45 and CC Docket No. 80-286 addressed many of the issues within the questions pertaining to the Benchmark Cost Model. GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

60. The National Cable Television Association proposed a number of modifications to the BCM related to switching cost, fill factors, digital loop carrier subscriber equipment, penetration assumptions, deployment of fiber versus copper technology assumptions, and service area interface costs. Which, if any, of these changes would be feasible and advisable to incorporate into the BCM?

GTE's prior submissions in D.96-45 and CC Docket No. 80-286 addressed many of the issues within the questions pertaining to the Benchmark Cost Model. GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

61. Should the support calculated using the Benchmark Cost Model also reflect subscriber income levels, as suggested by the Puerto Rico Telephone Company in its comments?

Under the program recommended by GTE, the level of support is not directly "calculated using the Benchmark Cost Model." High cost support would be calculated based upon a comparison of the output of the BCM with a benchmark affordable price established by the FCC and the Joint Board.

Individual subscriber characteristics, such as income or similar customer- or area-specific factors, should not be considered in distributing high-cost support. The need to support individuals whose income falls below a specified level should be addressed separately through a program of income-based support, similar to the current Lifeline program. Such a program would entail means-testing to determine eligible customers, so it would only apply to a relatively small subset of customers.

While the concept of tailoring support generally to fit each individual's need is attractive, it is not administratively feasible.³³ Means-testing every customer would be unreasonably burdensome and would involve an unacceptable intrusion in customer privacy. Even limiting means-testing to those requesting assistance would be complex and expensive and would involve private firms in an activity that is properly the role of a governmental agency. Further, the determination of the support needed for each customer would also require information on customer-specific costs and other factors,

³³ The attraction of customer-specific support is that it would eliminate the need to average support in an area. This, in turn, would eliminate the need for rate intervention and a consequent COLR obligation, or for any intervention in the rate, since the support provided would allow each customer to pay enough to induce a carrier to provide service.

which are unlikely to be available. In the absence of this information, support would still have to be averaged over some defined area.

There appears to be no useful way to use area-specific income data to adjust the average support amount provided in an area. If income data for a large area is used, it will not reflect variations in customer income very closely. If median or average income for a small geographic area is used, it will create very large variations in the amount of support provided. The problem with the latter approach is that even small areas are not very homogeneous with respect to household income. For example, a minimum-wage employee in a restaurant in Aspen may have to pay a very high price for telephone service if the "affordable" rate is based on the average or median income in Aspen. On balance, GTE recommends that income not be used to determine the amount of support provided in an area.

62. The BCM appears to compare unseparated costs, calculated using a proxy methodology, with a nationwide local benchmark rate. Does use of the BCM suggest that the costs calculated by the model would be recovered only through services included in the benchmark rate? Does the BCM require changes to existing separations and access charge rules? Is the model designed to change as those rules are changed? Does the comparison of model costs with a local rate affordability benchmark create an opportunity for over-recovery from universal service support mechanisms?

GTE's prior submissions in D.96-45 and CC Docket No. 80-286 addressed many of the issues within the questions pertaining to the Benchmark Cost Model. GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

63. Is it feasible and/or advisable to integrate the grid cell structure used in the Cost Proxy Model (CPM) proposed by Pacific Telesis into the BCM for identifying terrain and population in areas where population density is low?

GTE's prior submissions in D.96-45 and CC Docket No. 80-286 addressed many of the issues within the questions pertaining to the Benchmark Cost Model. GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

Cost Proxy Model Proposed by Pacific Telesis

64. Can the grid cell structure used in the CPM reasonably identify population distribution in sparsely-populated areas?

GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

65. Can the CPM be modified to identify terrain and soil type by grid cell?

GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

66. Can the CPM be used on a nationwide basis to estimate the cost of providing basic residential service?

GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

67. Using the CPM, what costs would be calculated by Census Block Group and by wire center for serving a rural, high-cost state (e.g., Arkansas)?

GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

68. Is the CPM a self-contained model, or does it rely on other models, and if so, to what extent?

GTE will provide more specific comments on August 9, 1996, in response to the Commission's Public Notice DA 96-1094, released July 10, 1996.

SLC/CCLC

69. If a portion of the CCL charge represents a subsidy to support universal service, what is the total amount of the subsidy? Please provide supporting evidence to substantiate such estimates. Supporting evidence should indicate the cost methodology used to estimate the magnitude of the subsidy (e.g., long-run incremental, short-run incremental, fully-distributed).

The CCL recovers all non-traffic sensitive loop costs that are not recovered through direct end user Subscriber Line Charge. Thus, all of the traffic sensitive CCL charge can be viewed as a subsidy to local service.

70. If a portion of the CCL charge represents a contribution to the recovery of loop costs, please identify and discuss alternatives to the CCL charge for recovery of those costs from all interstate telecommunications service providers (e.g., bulk billing, flat rate/per-line charge).

GTE recommends recovery of all loop costs through a combination of charges to the end user and Federal and state universal service support. Under GTE's plan, universal service support provided to an ILEC would be used to eliminate the CCL.³⁴

Low-Income Consumers

71. Should the new universal service fund provide support for the Lifeline and Linkup programs, in order to make those subsidies technologically and competitively neutral? If so, should the amount of the lifeline subsidy still be tied, as it is now, to the amount of the subscriber line charge?

Yes, the new universal service fund should generate funding for the Lifeline and Link Up America programs. Support should be made available to all low-income individuals that provide proof of meeting income level criteria established by a state regulatory agency.

³⁴ See GTE's D.96-45 Comments filed April 12, 1996, at 14-16.

³⁵ Self certification should not be adopted due to the possibility for misuse of support funding.

The amount of Lifeline subsidy should not be tied to the subscriber line charge or be linked with any other FCC's accounting, separations and access charge rules. This is necessary to be competitively neutral so that support may be available to *Elte/s* that are not required to use the FCC's accounting, separations or access charge rules.

Specifically, each Lifeline customer should receive a credit to offset the charges the customer selects. This program should not be tied to the interstate EUCL as it is today because only incumbent LECs assess such a charge.

Administration of Universal Service Support

72. Section 254(d) of the 1996 Act provides that the Commission may exempt carriers from contributing to the support of universal service if their contribution would be "de minimis." The conference report indicates that "[t]he conferees intend that this authority would only be used in cases where the administrative cost of collecting contributions from a carrier or carriers would exceed the contribution that carrier would otherwise have to make under the formula for contributions selected by the Commission." What levels of administrative costs should be expected per carrier under the various methods that have been proposed for funding (e.g., gross revenues, revenues net of payments to other carriers, retail revenues, etc.)?

GTE cannot offer estimates of the administrative costs under the various scenarios posed in question number 72. The most relevant information will be obtained directly from potential administrators through a competitive bidding process.

The overriding principle that should guide the Commission in examining any claims of exemption from payment into the fund is that of competitive equity. Such equity requires that all potential payers report the relevant data each reporting period. This will ensure that new entrants with high growth rates will not escape their fair

³⁶ GTE suggests that the amount of the credit should be at least equal to the EUCL, and that it be linked to an inflation index so the passage of time does not dilute the effectiveness of the program.

contribution when their size warrants contribution. Thus, requests for exemption from payment should be granted only for one reporting time period.

Respectfully submitted,

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Statement of Paul R. Milgrom

Attached to GTE's Comments in Response to Questions
CC Docket 96-45

I. Introduction

This statement presents a proposal to conduct a series of auctions to identify which firms should assume universal service obligations in each geographic area of the country and at what support level. A properly designed auction mechanism is a relatively quick, objective and straightforward market process that replaces more elaborate, subjective and opaque regulatory processes to determine the "who" and "at what price" of universal service support. What I suggest below is a flexible plan to implement auctions over time in those areas where circumstances permit their use.

As will be apparent from the discussion below, the Commission confronts a number of trade-offs in designing an auction. The comment period in the Commission's Notice is not sufficient for me to recommend to the Commission the optimal way of making those tradeoffs. For that reason, this statement should be considered an outline describing some of the main features that should be included in a COLR auction, rather than as a final, fixed proposal.

When there are two or more potential carriers of last resort (COLRs), auctions have several important advantages over industry cost models as a means of determining the support payments for meeting universal service obligations. First, an auction uses an actual market process to set support levels. That is desirable not only to avoid the controversies that inevitably accompany cost modeling and estimation but also because even the best cost models are both biased and incomplete as a basis for

setting support levels. Support payments based on cost models overestimate the actual level of support needed to attract a COLR when the LEC technology and facilities locations on which the models are based are not the least cost way to meet the COLR obligation. Also, when the LEC technology is the cheapest way to meet COLR obligations but competition in the provision of services is desired, support payments based on LEC costs may be too low to attract and sustain the desired competition, or perhaps any competition at all. Further, it is reasonable to assume that the firms' actual bids will be based on even more detailed cost estimates than could be reflected in an industry cost model and will be reduced to reflect the profit opportunities on any incidental or complementary services that the firm expects to sell along with basic services. No model that the Commission could plausibly implement would include so many factors or be based on such detailed cost analysis as the bids in an auction.

A second advantage is that auctions can determine how many COLRs should be supported and who they should be. Competition among potential COLRs can be of two kinds: "competition in the market" – in which several carriers accept COLR obligations and compete to acquire subscribers and the associated support payments – or "competition for the market" – in which companies bid for the right to serve as the exclusive COLR (or as one of a limited number of COLRs). "Competition in the market" is likely to lead to more innovative and responsive service to consumers and to reduce the severity of "hold up" problems that come from reliance on a single supplier. However, competition in the market can also result in duplicated facilities costs and burdensome support payments that necessitate imposing surcharges on other communications services. Competition "for the market" in a traditional auction can lead

to lower support payments as the bidders vie aggressively for the exclusive (or at least limited) right to serve as a COLR, reducing the burden on other services. Auctioning a fixed number of COLR designations would require the FCC to determine the fixed numbers: it must decide how many COLRs to authorize in each area. That determination would be a difficult and costly one for any regulator to make well because it would require extensive and reliable cost information and, possibly, market and technology forecasts.¹ By contrast, my proposal permits the number of COLRs to be an outcome of the auction itself, as auction participants place bids based on what will be inherently better cost information and on what they believe is the best information on future market and technological developments.

Third, by establishing actual market prices for universal service in the various service areas, the auction provides useful information to potential entrants. Market prices are useful for determining which markets may be ripe for entry and what cost targets need to be reached to make entry profitable in these markets. COLR auctions would also be likely to generate statistical information about service costs that the FCC might find useful in other proceedings and at other dates. For example, the FCC might use the auction results in markets with substantial competition to assess standards for LECs in regions where there is no competition

¹ I note that the recent Telecommunications Act appears to be largely premised on the presumption that the benefits of promoting entry will usually outweigh the costs, but the extent of entry will still vary among service areas and the auction design needs to be cognizant of that.

Another important advantage arises when service areas are re-auctioned over time, as I propose. A series of auctions allows the support payments to respond to changing technologies, population densities, and other factors. Probably, there will initially be some geographic areas in which only a single COLR operates but for which changing circumstances will eventually make competition among multiple COLRs feasible and desirable or in which reduced costs call for reduced support payments. The auction system can respond flexibly to changing circumstances, allowing entry to occur when the time is ripe and encouraging support payments to fall in tandem with the falling costs of service.

The auction proposal developed here calls for sealed tender auctions that would allow multiple COLRs to be selected if the several lowest bids are close enough together. The support levels would be the same for each COLR serving an area and would be set equal to the highest accepted bid.

This is a novel auction design, constructed to meet the novel challenges posed by the universal service context. While the FCC's simultaneous multiple round auctions have proved themselves to be effective for the spectrum sales with fixed numbers of licenses, I shall argue that such a design is less well suited to determine the extent of competition that should prevail among COLRs in each market area.

Section II of this statement examines theoretical considerations that apply in designing an auction to determine the amount of support and the level of competition simultaneously. Section III contains a specific proposal and a discussion of both the basic auction design and related practical details.

It is important to set realistic expectations about what a good auction design can and cannot achieve. Most importantly, auctions cannot resolve all the problems that may arise when there is a single facilities based universal service provider. If a single COLR with large sunk costs is the inevitable practical outcome in any particular geographic region, no auction, however cleverly it may be designed, can substitute for effective continuing regulation of the monopoly COLR.²

Second, an auction system cannot be effective unless the bidders have something to win. If one allows providers other than auction winners to provide basic service with support from the universal service fund, then that eliminates the bidders' incentives to bid for a low support levels,³ leading to undesirable increases in the surcharge needed to fund universal service.

II. Principles of Auction Design for COLR Obligations

The COLR auction design problem is characterized by a number of special features that distinguish it from other government auction design problems. First, in contrast to the spectrum auctions, the market structure in a universal service auction

² If an exclusive franchise is efficient but large sunk costs are not required, then there can be effective "competition for the market" each time the franchise is available for auction.

³ An auction could conceivably be designed in which the winner receives a cash bonus but no advantage in the subsequent market competition. However, our analysis in section II implies that such a scheme is never optimal.

would vary from area to area, as determined by the auction results.⁴ Consequently, the number of COLRs and the amount of support must be considered together in evaluating the performance of the auction. Second, to promote efficient competition among COLRs, it is desirable that the level of support in any area be the same for all COLRs. A “discriminatory” auction in which different bidders receive different levels of support, though useful in other settings, is to be avoided because such discrimination would distort subsequent market competition among COLRs.⁵ Third, if the proposals to use very small, homogeneous service areas are adopted, then the number of universal service areas is likely to be very large, making the administration of a complicated auction potentially quite costly for both the FCC and the bidders. Fourth, there is enormous uncertainty about the initial level of interest in the various COLR service areas, making it important to design an auction that discourages collusion in case the number of interested bidders in many areas is just two. Finally, because the bidders are undertaking an obligation in exchange for a payment (in contrast to making payments to acquire licenses in the FCC’s spectrum auctions), more attention must be paid to ensuring that bidders are qualified and motivated to perform as promised in the auction.

The mathematical analysis of this section accounts explicitly only for the first of these differences, but the way the mathematical results are applied takes some account

⁴ In the PCS auctions, the market structure was determined primarily by restrictions on the amount of spectrum that individual licensees are permitted to control. These restrictions were the same for all areas of the country.

⁵ The US Treasury uses a discriminatory auction to sell T-bills, but the individualized prices in that auction do not distort subsequent competition because the bids become sunk costs before the buyers engage in resale.

of the second, third and fourth differences as well.⁶ That is, we seek an auction design that is simple for the bidders and the administrators, that generates uniform levels of support for all COLRs in a market area, and that is resistant to collusion while still taking proper account of the benefits arising from competition after the auction among COLRs in the market.

To derive principles to guide the design of an auction for carrier of last resort obligations, I first consider a scenario in which there is just one region in which universal service needs support. The main problem in this scenario is to use the bids to determine how many COLRs there should be and what level of support to pay. The principal qualitative finding of the analysis is that the auction outcome should specify that the COLR obligation is shared only when the bidders' service costs are sufficiently close. This may be reflected by sufficiently close bids in a sealed bid auction. Of course, the detailed quantitative conclusions of the analysis, including how many COLRs to authorize for any particular cost or bid levels, depend on the detailed assumptions of the model, but the general conclusion reported here is sufficient to help us distinguish some poor auction designs from more desirable ones. For example, I find that multiple round auctions such as those used for the PCS auctions, even in the trivial case where there is just one COLR service area for sale, cannot generally implement the optimal

⁶ The last difference is a matter to be solved primarily by pre-qualification of the bidders and by specifying that the support payments are made on a per subscriber basis rather than by lump sums (at least when there is competition in the market). It is not a matter to be resolved directly through the auction design.

auction outcomes, but that certain sealed bid auctions can implement the optimal outcomes.

The theoretical analysis cannot specify how many COLRs should be assigned in any particular situation, but it can identify the relevant considerations. Generally, the number of COLRs should depend on the gains to increased competition in the ensuing market, the magnitude of the duplicated fixed costs (greater duplication favors fewer COLRs), the differences between the COLRs in the levels of their variable costs (smaller differences favor more COLRs), and the social loss associated with paying unnecessarily high support payments (larger losses favor fewer COLRs).

An Optimal Auction

I begin by assuming that there is just one region for which universal service must be provided (or where there are multiple regions but each is independent so that a commitment to serve one does not affect the cost of service in any other). The main problem is to use the bids to determine how many COLRs there should be and what support levels should be paid. Alternative auction designs are compared in this exercise in terms of a social objective which balances the desires (i) to encourage competition “in the market” in order to promote better and more innovative service to consumers, (ii) to have service provided by the providers for whom the actual cost of service is lowest, and (iii) to hold down the support levels that must be paid, since financing those supports distorts other economic decisions. The constraints in the problem are that the bidders are assumed to behave rationally entering the auction only if they expect to

profit by doing so (the "*participation constraint*") and bidding to maximize their individual expected earnings given the strategies of the other bidders (the "*incentive constraint*").⁷

I make the simplifying assumption that the fixed costs of service are the same across bidders.⁸ Also, at this stage, I assume that at least one COLR must be selected for each area.⁹ The solution to this problem can be characterized using the methods of optimal auction theory.¹⁰

The optimal auction problem is to choose the rules and the behavior of the bidders, subject to the constraints described above, to maximize the following three-term objective:

Expected Benefits to Consumers

– *Expected Costs Incurred by the COLRs*

– $\alpha \times$ *Expected Support Payments to COLRs*

⁷ That is, the strategies are assumed to form a Nash equilibrium of the auction game.

⁸ This is not an assumption I make happily. I make it because it makes the analysis tractable and leads to intuitively sensible results. Also, the auction obtained from the analysis has at least some robustness: identical recommendations are obtained when the ratio of fixed to variable costs are the same across bidders.

⁹ This assumption sets aside the question of reserves, i.e., maximum opening bids. As we shall see later, the franchises offered for auction are determined by a nomination process with a workable reserve determined as part of that process.

¹⁰ Myerson, Roger, "Optimal Auction Design," *Mathematics of Operations Research* 6 (1981): 58-73.

where α is a parameter indicating the costs of distortions created by the support payments to the COLRs.¹¹ The benefit to consumers is assumed to be B_1 if there is just one COLR; B_1+B_2 if there are two COLRs, and so on, with B_n denoting the incremental benefit of introducing an n^{th} COLR to compete in providing universal service.

The analysis characterizes the optimal auction in terms of the outcomes that ensue. To avoid technical problems, we limit our analysis here to what the modern economic auction theory literature calls the “regular case.”

Then, an auction design that always selects at least one winner is optimal if and only if its outcomes have these two characteristics: (1) bidders with sufficiently high costs cannot expect to profit from participating in the auction and (2) for any profile of actual costs, the set of bidders selected to be COLRs maximizes the expected benefits to consumers minus the expected costs incurred, minus α times a “*virtual cost*” (which is a theoretical construct consisting of the actual cost adjusted upwards to account for bidding incentives). If the bidders are otherwise symmetric, multiple COLRs are most likely when the low cost bidders' cost levels are close together.

One immediate implication of this characterization is that multiple round auctions, which the FCC has used successfully in other contexts, are not well adapted to this context. To see why, consider the simplest case with just two bidders. An efficient multiple round auction would then need to specify that a support payment near the

¹¹ More exactly, the distortion is created by the surcharge or tax used to finance the subsidy.

reserve is paid to both bidders if the auction ends immediately after opening bids near the reserve. With such rules, it is often consistent with rational behavior by both bidders for neither to lower the bid below the reserve even if the two bidders' costs are very different and much lower than the reserve.¹² In plain English, a multiple round auction that tries to implement the efficient outcome rule is exceptionally vulnerable to both explicit and implicit collusion. Such collusion is undesirable because it would be likely to result in unnecessarily high support payments and the inclusion of inefficient COLRs among the winning bidders.

An auction design that does encourage efficient outcomes in case there are just two bidders is the sealed tender auction in which two COLRs are assigned if the second lowest bid is close enough to the lowest bid. The support payment may be set equal to the highest accepted bid (although, as we shall see later, other payment rules are also permitted by the theory). An important advantage of the proposed sealed tender auction compared to the multiple round design is that it creates a powerful incentive for each bidder to defect from any pre-auction collusive agreement by undercutting its rival's bid in order to acquire the exclusive right to receive support payments for COLR services.

This analysis implies that an auction can be used to encourage competition both *for the market* and *in the market* even when there are only two bidders. Of course, the idea can also be extended to apply when there are more than two bidders. For a simple

¹² That is, strategies incorporating this behavior may comprise a Nash equilibrium.